MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

A5 **MATH 6205** DUE: MARCH 9TH, 2022

Upload your solution to Brightspace at the beginning of class on Wednesday March 9th, 2022.

1. Revisit the St. John's temperature prediction problem, this time with recurrent neural networks. That is, repeat all the steps from Assignment 3 (Question 2), now using persistence, linear regression and your MLP network as baselines and develop suitable recurrent neural networks (e.g. using LSTMs, GRUs, simple RNNs, etc.). Can your recurrent neural network architectures beat all the other methods you have implemented for Assignment 3?

2. We have briefly seen the WaveNet architecture in class. Here, the goal is to implement this architecture from scratch in Keras. For this, complete the following steps:

   (a) Read the original WaveNet paper: `https://arxiv.org/abs/1609.03499`. Note that the original WaveNet architecture was designed as generative model for raw audios, but since audio data can be interpreted as very long time series, WaveNets can also be used for general time series data.

   (b) The key architectural element of WaveNets is the *Wavenet block*, which is described in Figure 4 of the paper. Implement this WaveNet block using Keras' functional (or subclassing) API.

   (c) Once you have implemented the WaveNet architecture, use it for the St. John's temperature prediction problem as in Question 1. What are your observations in terms of training speed and accuracy in comparison to the other models you have implemented for this task so far?